

P24738

- 60 -

WHAT IS CLAIMED IS:

1. A head support mechanism, including:

a slider for carrying a head at least for performing reproduction of data from a disk; and

a holding portion for holding the slider, wherein the holding portion includes:

a first portion including a first piezoelectric element;

a second portion including a second piezoelectric element;

a third portion connected to the first and second portions, the slider being provided on the third portion; and

a fixing portion for fixing the first and second portions, and

at least one of the first and second piezoelectric elements is contracted and expanded in a direction substantially parallel to a surface of the disk, in the presence of an applied voltage so that the slider provided on the third portion is rotated around a predetermined center of rotation.

2. A head support mechanism according to claim 1, further including a load beam provided at a side of the holding portion opposite to the slider, wherein:

the load beam includes a dimple projecting toward the slider in such a manner as to apply a load to the slider;

the holding portion further includes a first joining portion for joining the first and third portions, and a second joining portion for joining the second and third portions; and

the dimple is provided at a substantially middle

FILED IN 24738

P24738

- 61 -

point between the first and second joining portions.

3. A head support mechanism according to claim 2, wherein the first and second joining portions include first and second elastic hinges, respectively, each having a width sufficient to reduce a load required for rotation of the slider.

4. A head support mechanism according to claim 3, wherein:  
the first and second portions include first and second conductor patterns provided along the first and second elastic hinges, respectively; and  
the first and second elastic hinges each have a minimum width required for providing the first and second conductor patterns, respectively.

5. A head support mechanism according to claim 1, further including:

a load beam provided at a side of the holding portion opposite to the slider; and

a slider holding plate provided between the third portion included in the holding portion and the load beam, wherein:

the load beam includes a dimple projecting toward the slider in such a manner as to press the third portion via the slider holding plate; and

the slider holding plate has such a shape that the center of gravity of a combination of the slider holding plate and the slider substantially corresponds to the predetermined center of rotation.

6. A head support mechanism according to claim 5, wherein the load beam includes a regulation portion for regulating

FILED 24738

F24738

- 62 -

the slider holding plate.

7. A head support mechanism according to claim 6, wherein the dimple contacts a point of the slider holding plate to support the slider holding plate pressing the third portion in such a manner that the third portion can be rotated in all directions including a pitch direction, a roll direction, and a yaw direction.

8. A head support mechanism according to claim 1, further including:

a load beam provided at a side of the holding portion opposite to the slider; and

a slider holding plate provided between the third portion included in the holding portion and the load beam, wherein:

the load beam includes a dimple projecting toward the slider in such a manner as to press the third portion via the slider holding plate; and

the slider provided on the third portion is rotated on the dimple acting as the predetermined center of rotation.

9. A head support mechanism according to claim 1, wherein the second portion is provided in such a manner that a distance between the second portion and the surface of the disk is substantially equal to a distance between the first portion and the surface of the disk.

10. A head support mechanism according to claim 1, wherein the first portion includes a first electrode for applying a voltage to the first piezoelectric element; and

the second portion includes a second electrode for applying a voltage to the second piezoelectric element.

00774470404

P24738

- 63 -

11. A head support mechanism according to claim 1, wherein:  
the first portion includes a first substrate;  
the second portion includes a second substrate;  
the first and second substrates are provided along  
a tangential direction of the disk; and

at least one of the first and second piezoelectric  
elements is contracted and expanded in a direction  
substantially parallel to the surface of the disk in such  
a manner that at least one of the first and second substrates  
is bent in a direction nearing or leaving the disk, so that  
the slider carrying the head is rotated by a small amount  
in a yaw direction.

12. A head support mechanism according to claim 11, wherein  
at least one of the first and second piezoelectric elements  
is contracted and expanded in a direction substantially  
parallel to the surface of the disk in such a manner that  
only one of the first and second substrates is bent in a  
direction nearing or leaving the disk, so that the slider  
carrying the head is rotated by a small amount in a yaw  
direction.

13. A head support mechanism according to claim 11, wherein  
the first and second portions further include first and  
second flexible materials covering the first and second  
piezoelectric elements and the first and second substrates,  
respectively.

14. A head support mechanism according to claim 1, wherein:  
the slider has an air bearing surface on which an  
appropriate air flow is generated between the slider and  
the rotating disk; and

FILED 24 SEP 2001

P24738

- 64 -

the third portion is arranged so that a center position of the air bearing surface substantially corresponds to the predetermined center of rotation.

15. A head support mechanism, including:

a slider for carrying a head at least for performing reproduction of data from a disk; and

a holding portion for holding the slider,

wherein the holding portion includes:

a first portion including a first piezoelectric element;

a second portion including a second piezoelectric element; and

a fixing portion for fixing the first and second portion, and

at least one of the first and second piezoelectric elements is contracted and expanded in a direction substantially parallel to a surface of the disk, in the presence of an applied voltage so that the slider is rotated around a predetermined center of rotation, and

the head support mechanism further includes:

a load beam provided at a side of the holding portion opposite to the slider; and

a slider holding plate provided between the holding portion and the load beam and provided at a position corresponding to the slider;

wherein:

the load beam includes a dimple projecting toward the slider in such a manner as to press the third portion via the slider holding plate; and

the slider holding plate has such a shape that the center of gravity of a combination of the slider holding plate and the slider substantially corresponds to the

RECEIVED 24 FEB 1960

P24738

- 65 -

predetermined center of rotation.

16. A head support mechanism according to claim 15, wherein:

the holding portion further includes a third portion, the slider being provided on the third portion; and

at least one of the first and second piezoelectric elements is contracted and expanded in a direction substantially parallel to the surface of the disk, in the presence of applied voltage so that the third portion is rotated around the predetermined center of rotation.

17. A head support mechanism according to claim 15, wherein:

the holding portion includes a first joining portion for joining the first and third portions, and a second joining portion for joining the second and third portions; and

the dimple is provided at a substantially middle point between the first and second joining portions.

18. A head support mechanism according to claim 15, wherein the slider is rotated on the dimple corresponding to the predetermined center of rotation.

19. A head support mechanism according to claim 15, wherein the second portion is provided in such a manner that a distance between the second portion and the surface of the disk is substantially equal to a distance between the first portion and the surface of the disk.

20. A method for producing a thin film piezoelectric element, including the steps of:

FILED 24738

P24738

- 66 -

a) forming a first metal electrode film, a first thin film piezoelectric element, and a second metal electrode film on a first substrate in this order;

b) forming a third metal electrode film, a second thin film piezoelectric element, and a fourth metal electrode film on a second substrate in this order;

c) attaching the second metal electrode film to the fourth metal electrode film;

d) removing the first substrate by etching;

e) shaping the first metal electrode film, the first thin film piezoelectric element, the second metal electrode film, the fourth metal electrode film, the second thin film piezoelectric element, and the third metal electrode film;

f) covering the first metal electrode film, the first thin film piezoelectric element, the second metal electrode film, the fourth metal electrode film, the second thin film piezoelectric element, and the third metal electrode film, with a coating resin; and

g) removing the second substrate by etching.

21. A method according to claim 20, wherein the first and second substrates are each a mono-crystal substrate.

22. A method according to claim 20, wherein:

the linear expansion coefficient of the first substrate is greater than the linear expansion coefficient of the first thin film piezoelectric element; and

the linear expansion coefficient of the second substrate is greater than the linear expansion coefficient of the second thin film piezoelectric element.

23. A method according to claim 20, wherein step c) includes attaching the second metal electrode film to the fourth metal

097447-013404

P24738

- 67 -

electrode film using a conductive adhesive.

24. A method according to claim 20, wherein step c) includes attaching the second metal electrode film to the fourth metal electrode film using a thermal melting technique using ultrasonic vibration.

25. A method according to claim 20, wherein:

step a) includes forming the first thin film piezoelectric element in such a manner that a polarization direction of the first thin film piezoelectric element substantially corresponds to a direction perpendicular to a surface of the first thin film piezoelectric element; and

step b) includes forming the second thin film piezoelectric element in such a manner that a polarization direction of the second thin film piezoelectric element substantially corresponds to a direction perpendicular to a surface of the second thin film piezoelectric element.

26. A thin film piezoelectric device, including:

a first metal electrode film;

a first thin film piezoelectric element provided on the first metal electrode film;

a second metal electrode film provided on the first thin film piezoelectric element;

a third metal electrode film;

a second thin film piezoelectric element provided on the third metal electrode film;

a fourth metal electrode film provided on the second thin film piezoelectric element; and

adhesive means for attaching the second metal electrode film to the fourth metal electrode film.

03744738



P24738

- 68 -

27. A thin film piezoelectric device according to claim 26, further including voltage applying means for applying a voltage to the thin film piezoelectric device, wherein the voltage applying means includes:

a first terminal for applying a driving voltage to the first and third metal electrode films; and

a second terminal for grounding the second and fourth metal electrode films.

28. A head support mechanism, including:

a slider for carrying a head: and

a holding portion for holding the slider,

wherein the holding portion includes:

a first portion including a first piezoelectric element;

a second portion including a second piezoelectric element;

a third portion connected to the first and second portions, the slider being provided on the third portion; and

a fixing portion for fixing the first and second portions, and

the first and second piezoelectric elements include a thin film piezoelectric device according to claim 26.